# RESEARCH THEMES AND TECHNOLOGICAL BASE PROGRAM IN BEHAVIORAL AND SOCIAL SCIENCES FOR THE U.S. ARMY

## 1976

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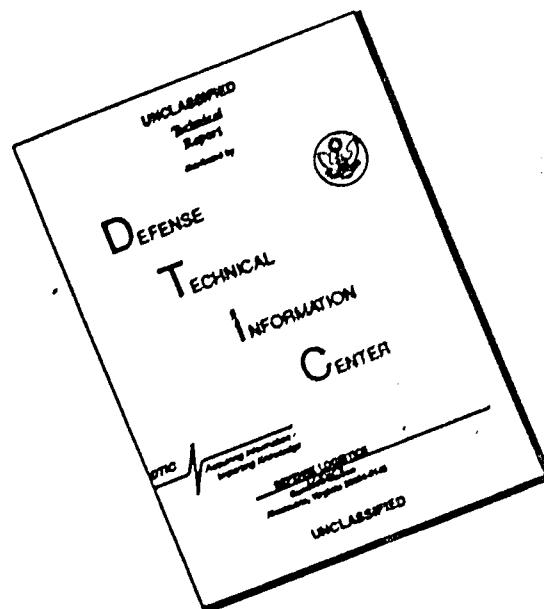
**Behavioral and Social Sciences**

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# FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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NOTICE

RESEARCH THEMES AND

TECHNOLOGICAL BASE PROGRAM IN BEHAVIORAL AND SOCIAL SCIENCES

FOR THE U. S. ARMY .

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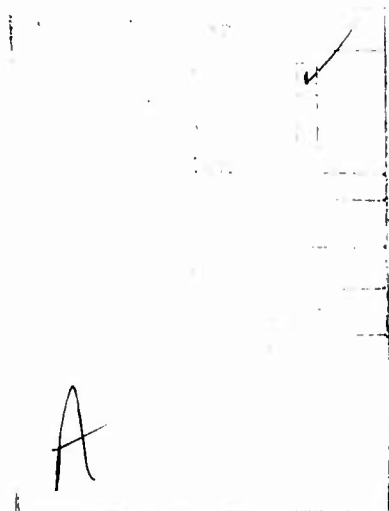
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# FOREWORD

This brochure describes in brief the Technological Base program of the U. S. Army Research Institute for the Behavioral and Social Sciences (ARI) including descriptions of Research Themes supporting this program. The Technological Base program is that part of the total research and development (R&D) program dealing with scientific theory, principles, knowledge, or method intended to advance the state of the art in military sciences and their subsequent application. Research Themes are defined as suggested areas for basic research required for the resolution of critical Army problems where progress has been inhibited by a lack of understanding of fundamentals or a scarcity of basic data.

Themes listed in this brochure may be considered as appropriate subjects for proposals for research grants or for research contracts. Some of the other Technological Base effort described may also be contracted although much of it will be done within ARI. Information on how to submit proposals for grants or contracts and general guidelines on the differences between grants and contracts are included in Appendix 2.

Publication of this brochure is intended to foster scientific dialogue between ARI scientists and those in other institutions whose research is related to ARI's program and who may wish to participate in this program. Proposals submitted in response to this brochure are considered unsolicited; accordingly prospective grantees or contractors planning to submit unsolicited proposals should not expect to receive specific details of ARI support requirements. When such requirements can be specified contract support is procured through advertised request for proposals.

Research proposals should be submitted to the Army Research Institute, ATTN: PERI-RC, Room 278, 1300 Wilson Boulevard, Arlington, VA 22209. A Military Themes brochure for mathematics and physical, engineering, and environmental science is published by U. S. Army Research Office, Box CM, Duke Station, Durham, NC 27706.

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## CONTENTS

# INTRODUCTION

Scientific understanding of individual and group behavior is critically important to the Army to provide for the effective use of its human resources. A review of the research program described herein will show that the Army's objectives in the use of the behavioral and social sciences in most respects parallel the objectives of other organizations, public or private, with heavy manpower requirements. Briefly, these objectives include recruiting, selection, classification, training, motivation, leadership, loyalty, work efficiency, effectiveness, low absenteeism, retention, individual growth, career guidance, equal opportunity, fair pay and promotion, pleasant interpersonal interactions and effective internal communication. The Army is particularly interested in young people who are about to enter the world of work or who are seeking education or training for employment. This group comprises the primary recruiting population.

On the other hand, there are some peculiarly military human resources problems, for example: evaluating combat readiness without combat; providing a desirable environment for military personnel in isolated, remote, foreign, hostile, or anti-military locations; and large scale operation, maintenance and support of new and highly sophisticated equipment.

Resolution of such problems requires a long range program. Research Themes are intended to evoke creative research ideas, innovative approaches and new theoretical constructs leading to long-term development in ways that may not be immediately obvious. Thus, the concepts guiding military themes research--theoretical orientation and technological goals--should be those of the researcher or his institution.

This brochure is organized by work unit area (WUA). Work unit areas are program segments, each of which includes research and development effort on closely related topics ranging from research through development to application. Themes are in the research category and represent the basic research end of the research-to-application continuum; the remaining technological base program, the exploratory development category, is intermediate; and advanced development represents the application end. The advanced development program is not included here because contract support requirements are more appropriately met by solicited contracts to deliver specified products.

The description of each WUA includes the scope and projected technological outputs. The Summary of Work Units provides the titles of specific exploratory development efforts which are formally planned, reviewed, specifically funded and will be undertaken. These work units represent effort that is less speculative than the Themes, have

a definite technological objective and are derived from a perceived fit between scientific knowledge and Army's requirements. Contracts supporting these efforts will be oriented to specific methods, approaches and goals. The Themes, on the other hand, describe areas for which advances in scientific knowledge, method and the state of the art are needed and will be funded when proposals describing attractive approaches to the topic are received from qualified investigators. Research support to investigators (other than in-house) can be provided in the form of a grant or contract.

## NOTE ON RESEARCH SAMPLES

Prospective research contractors and prospective grantees submitting unsolicited proposals for contracts or grants involving basic research on themes listed in this brochure should not assume that military personnel will be made available as subjects or participants, even though the effort is supported by Army funds. Because military personnel available as research participants are limited, priority is given in-house Army research agencies and those contractors lending direct support. Therefore, Headquarters, Department of the Army will not usually direct nor arrange for the use of military personnel as research participants in grant supported basic research.

Within the scope of his command authority, however, a local Army commander may, at his discretion, permit participation of military personnel on active duty in behavioral or social science research supported by grants or contracts. Commander's approval could be given when, in his judgment, participation would be of distinct benefit to the units or personnel involved, will contribute to (or at least not interfere with) the mission of his command, would not discredit the Army or his command, and will not compromise base security.

Survey, test, or experimental data already collected, or data from Army records, may be made available to grantees for research purposes. Contract research supporting the exploratory development program may use military participants when appropriate.

Work Unit Area:  Individual Training Technology and Skill Evaluation

Scope:

a.  Objectives:  To develop principles and a data base for improving complex individual training and skill evaluation areas.

(1)  Develop a model to guide the development of criterion-referenced performance tests in specific MOS.

(2)  Develop procedures and techniques to systems engineer technically demanding MOS with complex task requirements.

(3)  Develop a methodology for predicting effectiveness of performance-based job and training literature.

(4)  Investigate and devise methods and information to support job-oriented, realistic, individualized performance-based training and job performance aids for soldiers at duty stations.

b.  Background and Summary:

1.  Performance tests have been developed for use in entry level MOS training courses, and these can serve as a basis for developing performance tests to use at high skills level to evaluate MOS proficiency.  Procedures need to be developed for performance tests that provide valid measurement of proficiency; issues that need resolving include (a) sampling of job tasks to include in the performance tests, (b) procedures for obtaining objective and accurate evaluations of performance, and (c) procedures for obtaining, calibrating, and maintaining necessary equipment.

(2)  Courses taught at Army Training Centers (ATC) have been redesigned to make them more performance based through the application of procedures that have already been worked out.  The more technical courses, however, have not been re-engineered following the same systematic procedures, and hence research is required to develop procedures for re-engineering the courses and MOS with more complex tasks.

(3)  The Army is actively involved in revising and redesigning its job and training literature to provide more effective literature support for performance-based training, job performance, and for the the individual soldier's use in preparing for Skill Qualification Tests.  Currently, there are no well developed methodologies for testing the validity of these state-of-the-art hypotheses.  Thus, while new training literature is being designed and produced, we do not have methodology for assessing the extent to which the new literature is more effective than the older traditional literature.

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(4)  The Army is seeking to improve and maintain maximum combat
readiness of lean Active and Reserve Forces to successfully meet and
overcome attack by larger and more fully equipped aggressors, anytime,
anywhere.  Highest efficiency and economy in using Army manpower, money,
time, equipment and supplies can be reached only by up-to-date training
methods and equipment, identified and developed as the basis of sound
fundamental research to get the highest possible return for training
dollars and effort invested.  A major thrust of this activity which
requires continuing research input is the shift of job-related training
closer to the place and time in which individuals must perform their
jobs.

c.  Projection:

(1)  Development of performance tests for some tasks will be com-
pleted, and the first stages of developing a model of performance
testing will be completed.

(2)  Task analysis of selected technical MOS will be undertaken to
use in restructuring the training courses and in developing performance
tests, as appropriate.

(3)  Development of methodology to test the effectiveness of new
manuals in their intended job or training context will begin, considering
comprehensibility, readership and useability.

(4)  Operational and parametric investigations will be undertaken of
training strategies to insure decentralized optimal skill acquisition
and retention, of techniques to simulate realistic job tasks, of prin-
ciples and methods for conducting cost-effectiveness analyses of training,
of means for evaluating and specifying training and job performance
aids.

Projected Technological Outputs:

a.  Procedures for developing and operationally using performance
tests to evaluate MOS proficiency.

b.  Procedures for restructuring technical MOS training courses to
make them more performance based and job functional.

c.  Methodology for testing the effectiveness of new job and training
literature relative to older, traditional literature.

d.  Methods, procedures and data for specifying and evaluating
training, instructional adjuncts and job performance aids for use by
individuals in non-institutional environments.

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Summary of Work Units:

a. Development of a Model for Criterion-Referenced Performance tests

b. Systems Engineering of High Skill MOS

c. Development of a Methodology for Predicting Effectiveness of Performance-based Job and Training Literature

d. Individual Training Technology

Themes:

a. Development and validation of culture-fair as compared with culturally-based cognitive tests.

Research on human intelligence has isolated cognitive tasks representative of culture-free as differentiated from culture-bound intelligence. Further research is required on the nature and measurement of these cognitive tasks to enable culture-fair cognitive assessment.

b. Determine the effects on human performance of the individual's role in learning situations.

Previous research measuring error rates during training has shown superiority of observational learning over performance when both the observer and the performer have immediate feedback. Research is required on variables influencing the efficiency of observational learning and how performance can most effectively complement observation.

c. Determine effective strategies for observing and evaluating human performance.

Improvement of performance testing depends upon better understanding of the basic processes whereby judges observe and evaluate the performance of examinees. Important variables include task characteristics and interaction requirements, i.e. whether the examinee performs as an individual or as a member of a crew.

d. Determine the effects of task characteristics on learning and performance.

Variation in stimulus materials on the concrete-abstract dimension appears to produce differential human information processing strategies. Concrete stimuli exert unifying or organizing effects that function as memory cues, while abstract stimuli produce sequential processing. Further research is required to examine the effects of these stimulus characteristics on concept learning by humans.

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e.  Interests and values of workers as related to job clusters.

Optimal classification and training involves matching the abilities, interests and values of individuals to the demands of jobs. Research is required to find the human and situational characteristics that enhance the individual's career development.

f.  The use of illustrations in instructional textual material.

Study of types, frequency and interchangeability of illustrations with related instructional text material.

g.  Development or adaptation of statistical techniques for analysis and validation of performance tests.

Criterion-referenced (CR) and performance-based (PB) testing are used increasingly as replacements for norm-referenced, paper-pencil testing to insure more equitable and valid training and performance evaluation.  Little of the voluminous testing and measurement literature or of the tried and accepted techniques for designing and evaluating norm-referenced tests is applicable to CR or PB testing.  The goals of this research effort include:  identification and compilation of techniques and data suitable for direct use in CR and PB testing; and delineation of probable high-yield problem areas for theoretical and experimental attack.

h.  Establishment of decision rules for matching type of job performance with appropriate training methods.

Research is needed to enable identification and selection techniques for choosing among instructional strategies and devices to accomplish effective and efficient performance skill development.

i.  Engineering media developments and their potential application to individual, non-resident training.

Continuing engineering advances in communications and information storage and retrieval possess considerable promise for adaptation to the training needs of dispersed individuals.  (One such development, Disco-Vision (TM), a high information density, laser-read, audio-visual storage mechanism may allow rapid random access to large files of visual and auditory material and collections of data, through conventional video reception equipment.)

Collection and analysis of current pertinent developments, whether complete or underway, is to be followed by projected cost, efficiency, and other practicability estimates and recommendations for implementations of flexible, convenient and effective small devices or hybrids which use in-place utilities for ready-access individualized instruction.

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Work Unit Area:   Personnel Accession and Utilization

Scope:

a.  Objectives:  Together with counterpart Advanced Development
research, to provide the basis for a broad base attack on Army problems
of identifying trainable manpower, to include manpower inventory,
screening, selection, assignment, criteria of performance, and
careerist identification.

(1)  To devise new and improved techniques for development of
performance tests as supplementary instruments for the screening
of enlisted personnel.

(2)  To investigate utilization of computer technology in
military testing.

b.  Background and Summary:

(1)  The performance test research is focusing on development
of a technology for measuring nonintellectual personal characteristics
which will differentiate effective from ineffective soldiers.  The
technology, when developed, will provide tests for supplementary
screening of individuals scoring in the marginal range on measures
of general and specific abilities.  Performance tasks for a preliminary
form of a test have been developed, and transferred into the Advanced
Development program for validation.

(2)  A laboratory device utilizing the ARI computer has been
constructed to administer and score multiple-choice test items.
This device has been tried out with selected types of item content.

c.  Projection:

(1)  Research in performance test techniques will involve deriving
additional measurement approaches to the problem of performance testing
of nonintellectual factors associated with enlisted success, and con-
struction and tryout of tasks utilizing those approaches.  As the
approaches and their tasks give preliminary indication of validity
and utility they will be transferred into the Advanced Development
program for development and evaluation as an operational screening
device.

(2)  Utilization of computer technology in testing will proceed
with investigation of a broad family of types of multiple-choice
tests.  These will include tests involving vocabulary and paragraph
prose verbal items, quantitative items, pictorial nonverbal items, and
tests in which speed of response is being assessed.

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Projected Technological Outputs:

a.  A methodology for assessment of nonintellectual qualities associated with enlisted success.

b.  Methods for utilization of computer technology to accomplish administrative and psychometric advances in military testings.

Summary of Work Units:

a.  Techniques for Development of Performance Tests as Supplementary Screening Measures

b.  Investigation of New Test Techniques

Themes:

a.  Sex Differences in Aptitude and their Measurement

Among the usually accepted components of general mental ability, spatial aptitudes seem to be most closely sex-bound, yielding sizable and reliable differences between men and women.  Research on spatial visualization relative to the following would be of interest: (a) sex differences, (b) relationship to preferred handedness, (c) relationship to accepted measures of neurological hemispheric dominance, (d) relationship to social/emotional factors.  Similar relationships to identify controls for sex bias in other aptitude measures would be equally relevant.

b.  Component Elements of Judgment of Criterion Performance

Determine basic elements in the assessment of criterion performance as judged by observers or evaluators.  Determine which aspects of performance can be reliably discriminated by observers and which of these aspects contribute most to overall judgment.  Determine the relative variability of task performance ratings over a set of observers and over a set of repeated performances (observations).

c.  Computer Aided Testing for Military Qualification and Military Occupational Classification

The Army is exploring utilization of computer aided testing methodology to increase the precision of its tests and to reduce testing time.  Research examining different test models, types of tests (e.g., speed vs. power, interests vs. aptitudes), other properties of computer aiding, would be beneficial.

d.  Cost-effective Military Screening Strategies

Employment, as soldiers, of individuals who perform unsatis-
factorily is of sizable cost to the taxpayer.  Alternatively, being so
selective as to leave military jobs unfilled is detrimental to national
defense.  Research to investigate a range of alternative screening
strategies, with their respective costs and benefits, would be beneficial.

e.  Military Manpower Retention

Research focusing on manpower retention, appropriate expec-
tations, system factors which may be counterproductive, methods of
increasing reenlistment rates among the qualified, would all be helpful
to the Army.

f.  Adjustment to the First Full-Time Job

The military services hire men and women for what is, in a great
many cases, their first full-time job.  Research on the psychology of the
first job, expectations of employer and employee, tenure, factors in
separation, and so forth, would be helpful.

g.  Factors in the Military Occupational Choice Decision of Women

Men and women are assignable to all (almost) of the same
jobs in the Army.  Imbalances exist in the expressed preferences of
women, and research to determine the bases for these preferences and
aversions, would be of help.

h.  Personal History Data for Differential Occupational Success
    Prediction

History repeats itself, and elements in the background of
job candidates can be utilized to increase the accuracy of qualification
and differential job classification decisions.  Research is needed to
bring biographical data prediction into sharp focus for use by the
military.

Work Unit Area: Career Progression Systems

Scope:

a. Objectives: Together with counterpart Advanced Development research, to provide major effort on improved career development and management for Army officer and enlisted personnel.

(1) To provide models and technology to support qualitative personnel requirements of the Officer Personnel Management System (OPMS) and the Enlisted Personnel Management System (EPMS); to design and develop a career counseling/information system responsive to these requirements and to career needs of individual officers and enlisted personnel.

(2) To provide definition of the training and experience demands of successively higher positions in the career progression system, supporting information base requirements for skill qualification test development and feedback to service schools and other training situations for continuing evaluation of training effectiveness.

b. Background and Summary:

(1) Study of the current state-of-the-art, both in counseling techniques and in applications of computerized technology, reveals that innovative approaches have been effectively designed and utilized in educational and industrial settings. The usefulness of computer-aided career counseling/management techniques is being explored in the integrated context of officer career development and the officer requisition and assignment system.

(2) Previous research has developed a .new methodology--"duty modules"--defining performance requirements of military officer assignments in terms of specific functionally integrated .sets of skills. This technique provides the basis for defining relationships among MOS and career specialties and the training, experience, and potential required for individual progression through successive career development assignments. Concurrently, military studies and a recent ARI survey of Army officers revealed needs for improved career information and career guidance. Model dialogues, data bases, and supporting computer hardware and software components have been integrated for field testing with junior officers.

c. Projections:

(1) Methodology for quantitative relationships of separate job requirements among assignment options to determine transfer of training and experience requirements in support of training effectiveness and optimal differential career progression under OPMS and EPMS.

(2) Definition of components of prototype career information system, utilizing advances in career counseling theory and computerized technology for a cost-effective system supporting OPMS and EPMS.

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(3) Report on training technology instructions and devices for assessment and feedback for use of ROTC and Army schools' instructional staffs.

Summary of Work Units:

a. Career Management Systems Research

b. Individual Career Development Research

Themes:

a. Measurement of cost effectiveness of career information system

Innovative approaches are needed for measurement of the cost and utility of alternative career information systems for individual career progression planning. Among considerations to be included are the identification of relevant criteria; a methodology for quantitative evaluation of career choice outcomes; definition of different types of costs and utilities; a methodology for quantifying these costs and utilities.

b. New approaches to career decision-making

Innovative methods are needed for developing awareness of and participation in long-range career planning strategies on the part of Army officers. Methodology is needed for an interactive mode for information exchange between the individual officer and his Army career management records, for orientation/instructional material on basic concepts of career planning strategies, necessity for career decisions at key choice points, and concepts of career choice in relation to personal values, experiences, and potential personal development. Methodology developed should be adaptable to use at significant choice points throughout the Army officer's career.

c. Cost effective models for career gaming

The possibility of being able to play a "career game" which would simulate a variety of career paths and outcomes stemming from different decisions at key career points is intrinsically appealing to the Army officer. Moreover, a model of this kind, if it can be cost-effective, would be highly instructive and useful. The capabilities of computer technology would appear to be required. Required for such a career game is an up-to-date realistic data base; obtaining and maintaining such a data base is fundamental and represents one of the problem areas needing solution.

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d.  Methodology for determining comparability of requirements between assignments and rate of change in assignment requirements

Quantitative techniques are required for the creation of similarity indices between assignment pairs in terms of job demands in the separate assignments.  Such techniques should be based on the already developed "duty module" deliniation of assignments in the OPMS and should consider factors such as criticality of the duty module element, proportion of time spent, and type of incumbent participation in the total assignment. Methodology should be expanded to generalize in determining rate of change and consequent obsolescence of assignment definitions so that training/development programs can be modified expeditiously.

Work Unit Area:    Performance-Based Leadership Development Processes

Scope:

a.    Objectives:   Provide base data for developing instruments, techniques and methods for use in selection, assignment, assessment, training and leadership development.

(1)    Develop a career commitment model to provide base data about the attitudes and factors relevant to career decisions of college students particularly as these relate to joining the ROTC program and to the Army as a career.

(2)    Provide data on cost effective, performance based techniques for use in assessment, training and leadership development.

(3)    Develop techniques to provide feedback on performance effectiveness to facilitate the leadership development process.

(4)    Provide base data on the impact the leader has on unit effectiveness as a function of leader characteristics, behavior patterns, performance style and situational variables.

b.    Background and Summary:

(1)    Tech Base research effort to develop a descriptive model of the career commitment process has been undertaken with contract support. This effort will provide (a)  a career commitment model which provides a description of the career development process and the major shaping factors during the individuals college phase (b)  proto-type instruments for measuring career orientation and degree of commitment at critical points during the individuals college phase and (c)  Base data for use in recruiting selection, assignment and retention in the ROTC program and early career.

(2)    Research to provide a data base on cost effective performance based techniques for use in assessment, leadership development, and training in military hard skills is being conducted thru both in-house and contract research efforts.   This research is designed to (a)  Provide guidelines for feedback procedures in performance based leadership development and training situations, using such media as video tape, trained counselors, associates, instructors etc. (b) Develop instructional techniques to economically train users in "Hands On" assessment training and leadership development simulations (c) Provide guidelines for constructuring simulations and group and individual interactive games for assessment, training, and leadership development which are based on subject matter content of specific courses.   (d) Provide base data for developing performance based assessment of professional competence at next higher level of responsibility.

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(3) Exploratory research to obtain base data relating both situational and leader personality variables and their interactions to unit effectiveness. This research will contribute to a better understanding of the leaders impact on unit effectiveness as a function of leader, organizational and situational variables.

c. FY 76 Projection:

(1) Exploratory research was initiated under a grant to the University of Wisconsin on development of a subject matter based simulation. This initial work will be further developed into an interactive tactics game for use in training and leadership development in the ROTC program. Concurrently an assessment procedure to fit this simulation is also being researched.

(2) A two year contract effort was initiated with the American Institutes for Research designed to bring together existing base data on the career development process, and to identify the major dimensions impacting on it as well as conducting new research necessary to formulate an operational model of the process. The research would provide a data base and proto type instruments for recruiting, selection and assignment in the ROTC program. This research will also impact on career development in the early years of career officers. Early spinoffs from this effort will be utilized by TRADOC in ROTC recruiting and program development.

(3) Research will continue in development of techniques used in assessment and performance feed back such as use of video recordings, methods of getting cost effective associate observations and performance evaluations, minimizing performance time requirements and minimizing need for assessors and performance control personnel.

(4) Exploratory research will be initiated to test theoretical concepts relating group effectiveness to characteristics of the leader and those of the group and the resulting interaction. This will provide base data for testing unit effectiveness as it is affected by its personnel composition, mission requirements, organizational structure etc as well as the impact of the leaders behavior on the units effectiveness.

Projected Technological Outputs:

a. A descriptive career commitment model and associated data base for use in advanced development research on recruiting approaches, selection, and assignment in the ROTC program.

b. Guidelines for developing interactive, course subject matter based games in the ROTC program for assessment of leadership skills, training in subject matter and development of effective leadership behavior.

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c. Proto type leadership evaluation scheme for use in assessing and facilitating the development of leadership skills in performance based situations on campus in the ROTC programs.

d. Development of a proto-type instructional procedure to train evaluators and controlers to conduct interactive games for assessment and leadership development.

e. Data base to provide research guidelines for leadership training and development, designed to enhance leader effectiveness by improving awareness and consideration of group and situational factors.

Summary of Work Units:

a. Leadership Skills Development Processes

b. Selection for Retention

Themes:

a. Leadership Assessment and Development Techniques for use within Organized Groups in Operational Situations

Research would be directed at finding techniques which can be used to define and measure leader characteristics and group functioning in ways which can serve as bases for individual leader development. The techniques would account for major differences in leadership style as they interact with job situations and organizational purposes.

b. Performance Feedback. Techniques for Use in Leadership Training and Development

The training and development of leadership skills, particularly in exercises and simulations, require feedback to the learner. This research would examine the effectiveness and impact of different feedback forms, contents, media, and combinations thereof. Consideration would be given to demonstrating long and short term consequences.

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Work Unit Area:  Leadership Training Program Evaluation

Scope:

a.  Objectives:  To provide research-based methodology for conduct
and evaluation of the training and development of Army leaders, with
identification of the primary dimensions of leadership behavior, recog-
nition of individual differences in leadership profiles, and program
assessment in terms of both individual and group performance.

(1)  Through relatively small-scale experimentation in available
Army school situations, to build the various methodological components
which can be assembled into an integrated technology for developing the
skills required in face-to-face leadership (in both combat and technical/
managerial domains), with maximum feasible introduction of the analogous
"hands-on" principle.

(2)  To provide a systems-engineered program of training for
company command, suitable for incorporation in Branch Officer Advanced
Courses and application to command development in units.

b.  Background and Summary:  The Technological Base research under
this Work Unit Area builds in part on the findings of the earlier ARI
research in which several hundred lieutenants executed a variety of
situational performance tasks under conditions of total simulation,
including simulated combat.  A major result of data analysis in that
research was the clear differentiation between combat leadership per-
formance and technical/managerial leadership performance.  Another
finding was the rather remarkable extent to which the lieutenants tended
to regard their participation as a helpful educational experience.  This
Work Unit Area takes cognizance of those findings, and contributes Tech-
nological Base for Applied Development Work Unit Evaluation of Senior
ROTC Program of Instruction.

(1)  With the cooperation of the U. S. Army Engineer School,
research was undertaken in the Engineer Officer and NCO Basic Courses
in the area of leadership training, development, and assessment.  Pre-
testing by means of the Officer Evaluation Battery and the NCO Evaluation
Battery had been established and, during the course, peer ratings of
leadership were obtained.  Scores on practical exercises and other
leadership-related course activities were obtained for analysis.  Efforts
were directed to improvement and selection of available leadership-
related scores, with possible cooperative addition of new exercise com-
ponents; improved feed-back to the student of his performance in the
evaluation battery and in leadership-related course activities; and
improved counseling and performance coaching based on these data.
Effectiveness of evaluations and techniques were studied through re-
lationships with subsequent performance.  A major methodological focus

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involved introduction of technologies from previous ARI research, and development of new technologies, for assessing the effectiveness of experimental training programs in terms of their impact on later performance of both individuals and teams.

(2) Under Advanced Development Work Unit, Systems-Engineered Experiential Training for Company Command in USAREUR, previously developed systems-engineering procedures and results of previous ARI research were applied to define USAREUR company-level problems, identify successful company commanders, and determine their leadership practices and experience-based solutions. Data on problems confronting company commanders and on techniques successful in coping with them were obtained outside USAREUR and integrated with USAREUR findings to produce instructional content pertinent across the range of Branch Officer Advanced Courses.

c.  FY 76 Projection:

Research will be continued on evaluation of current ROTC programs of selection and instruction against criteria of the Officer Basic Course and first assignment performance, and development of performance-based training and feed-back techniques for potential use in an integrated leadership training and performance evaluation program. Also included will be the development, standardization, and validation of a battalion/ brigade level game for the Infantry Officer Advanced Course, identification of company commanders' job requirements and development of leadership training courses in USAREUR, development of interpersonal skills training modules to supplement NCO training, and application of assessment techniques from the US Army Infantry School Assessment Center for cost-effective use in OCS selection and OAC leadership training.

Projected Technological Outputs:

a.  Technology for an integrated system of leadership training involving assessment, counseling, and career motivation.

b.  A systems-engineered experiential module of company commander training for Officer Advanced Courses, integrating experience-based and research-based leadership practices for improved effectiveness of company command and administration.

Summary of Work Units:

a.  Methodology for OBC and NCO Leadership Training and Development

b.  Individual Training for Company Command

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Themes:

a.  Modifiability of Leadership Styles through Experiential Training and Performance Coaching.

In an experiential leadership-learning situation, coaching may be primarily directive or primarily nondirective (eductive) focusing in a hortatory way on leadership way on leadership styles or in a counseling way on specific behaviors. Do these approaches differ in their ability to modify a trainee's leadership style?

b.  Interaction of Experiential Training Techniques with Traditional Classroom Techniques in an Integrated Training Program.

Simulations, games, and other experiential training techniques have proven highly promising in terms of motivating students through inducing a problem-solving approach and emphasizing relevance of the "real-world" content of such exercises. One effect may be to enhance the information acquisition process in more traditional training settings such as lecture, discussion, and individual reading-learning programs. Research in which various integrated sequences of experiential and traditional techniques are experimentally administered could well lead to optimum design of training sequences, especially in leadership-executive development and other domains where the integration of hard and soft skills is paramount.

c.  Development of New Criteria for Evaluation of Effectiveness of Training Programs in Given Institutional-organizational Settings.

Effectiveness of training programs depends upon the interaction of student input qualities and training methods and content with institutional-organizational settings in which the program is conducted. New criteria, including performance of graduates, are needed to facilitate identifying the main and interaction effects of student, training program, and organization in such a way as to lead to system-oriented recommendations for program policy and technique changes.

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Work Unit Area:   Officer Career Management Systems

Scope:

a.   Objectives:  To design an officer career progression system,
supporting the qualitative personnel requirements of the officer corps,
the developing Officer Personnel Management System (OPMS)' and the Officer
Evaluation System (OES).  This central objective includes the following
specific objectives:

(1)   Development of a model career progression lattice, based on
officer MOS, duty module, and skills analysis, delineating within-branch
and cross-branch career development patterns leading to 0-6 positions
in command, functional staff, and special career programs.  This research
supports officer personnel management and career counseling in the
Advanced Development program.

(2)   Identification of the training and experience demands of
successively higher positions in the career progression system, sup-
porting the development of new and improved indices for personnel
management in selection for service schools, graduate programs, key
assignments, and promotion.

(3)   Design and development of a data bank, incorporated in
the Officer Master Tape Record and other parts of the personnel records
system.  This design would permit different modes of access in order
that records appropriate for personnel management, for counseling,
and for individual officer self-development use be kept separate where
confidentiality requires it, while facilitating ready accessibility
for personnel management and individual career development needs.

(4)   Development o. alternative techniques and strategies of
operational performance evaluations directed toward solving recurrent
problems of the OES, e.g. inflation, lack of differentiation among
intra-individual qualities, inadequate behavioral reference.

b.   Background and Summary:

(1)   Previous BESRL research identified major domains of leadership
behavior and developed techniques to evaluate differential performance in
the domains of combat leadership and technical-managerial leadership in an
assessment situation.  This research has also provided measures of personal
characteristics related to these separate dimensions of leadership to permit
the evaluation of differential potential of personnel.  These results con-
tributed a research basis for development and implementation of a new officer
career structure -- OPMS - which capitalizes on the concepts of differential
leadership potential, through separate career progression channels of command
specialization, and functionalization, in contrast to the former broad general
development concept.

(2) Recent research has provided a new technique--"duty modules"--for definition of officer assignment requirements in terms of specific unitary functions, rather than in the broad MOS context only. The technique provides capability for an inventory of these unitary functions across the total assignment structure, and for a parallel inventory of the training or experience requirements for these same functions across the officer corps. Comparison between the assignment requirements and the training/experience pool will support Advanced Development research to provide a better information base for differential career development, for use by both career managers and the individual officer in training and assignment decisions.

c.  FY 76 Projections:

(1)  Research on career progression models to support the Officer Career Management Systems requirements of OPMS will be expanded to develop methodology for definition of relationship between alternate career progression paths and previous training as experience requirements. Concurrently, research will continue on techniques to evaluate performance and potential of the individual officer and develop an appropriate data base for use in career decision at these alternate points.

(2)  Concurrent with development of techniques for alternate career progression paths, research will focus on assignment requirements applicable to command and key positions, and to identify special assignment requirements which have unique demands independent of previous training and experience. These requirements will then be analyzed to serve in development of measures of individual potential related to them.

(3)  Research will be conducted on construction of methodological techniques for categorization and quantification of subject content in narrative description of performance and potential for application to the OES.

(4)  Research will be conducted on indices of differential leadership potential, experimentally introduced in all Officer Basic Courses, including both peer ratings and the Officer Evaluation Battery.

Projected Technological Outputs:

a.  Technique for relating OPMS assignment requirements in "duty module" terms to the training-experience potential capabilities inventory of the officer corps, and the integrating of these requirements for development of the OPMS

b.  Model for data base (e.g. Officer Master Tape Record) to meet career management requirements in support of OPMS

c.  Methodology for content analysis of narrative performance evaluations on the Officer Efficiency Report

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d.   Report on methodology for differential leadership evaluation in Officer Basic Courses, including applicability and utility of peer ratings and the Officer Evaluation Battery.

Summary of Work Units:

a.   Officer Career Management Systems

b.   Officer Career Appraisal Techniques

Themes:

a.   Effects of Associate Ratings on Group Cohesivieness and Performance

Determine the modifying effects of peer ratings on individual behavior and interpersonal behavior within the peer group.  Given the demonstrated effects of evaluation anxiety upon test performance, are similar effects found in the social climate of the group in anticipation of peer evaluations, or are there facilitating effects of greater interaction and group cohesiveness?  Analyses should consider modifications induced by peer ratings on individual and group performance, personal satisfaction, and attitudinal change.

b.   Effectiveness of Different Evaluative Techniques and Power on Subsequent Performance

Traditionally, performance ratings have been made by the immediate superior.  There is a need to investigate the rating role of the superior, both in relationship to the prescribed rating procedure and the degree of autonomy exercised.  Additionally, there is an interest in expansion of the "rater" concept to include as raters, both subordinates, and associates of same senority level, regardless of position.  Thus the investigation should focus on relationships of rater roles and rating techniques, and their impact on the attitudes and subsequent performance of the rated officer.

c.   Investigation of the similarity and transferability of skills required for executive performance at the separate levels of command: straw boss to policy maker.

The degree and type of leadership shills required at the different organizational levels have not been studied in a systematic manner.  There is a need to investigate relative contributions of separate leadership skills to performance at different organizational levels, and the interrelationships among these skills.  Research should investigate problems of selection, training and utilization for one organizational level in relation to manner of later performance in higher organizational levels.

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Work Unit Area:  Occupational Measurement and Occupational Engineering

Scope:

    a.  Objectives:  To develop the technological and methodological base for improving occupational analysis techniques and the application of occupational research methodologies to design new systems and provide innovations in existing systems for enhancing the feedback processes essential to effective training and personnel management.

    (1)  To design and explore occupational analysis techniques and to determine the techniques most compatible to relating types of job structures, work requirements, and personnel system needs.

    (2)  To provide the prototype models for conducting multi-phased occupational measurement processes addressing interactive problems in training, on-the-job performance standards, and allocation of personnel skills.

    (3)  To provide methodologies for:  (a) identifying relationships between criterion-task skills and performance on job assignments, and (b) the evaluation of such skills in relation to job levels and mission goals.

    b.  Background and Summary:

    (1)  The best utilization of personnel in a cost effective context requires more knowledge regarding where and how soldiers are to be assigned. This knowledge will only be provided by a system which provides continuing and accurate job performance information based on detailed job and training analyses.  The formatting and coding of this information is as important as the obtaining of valid content in the design and implementation of such a system.

    (2)  Certain indications from training managers and personnel administrators have pin-pointed pressing demands for methodologies and techniques by which comprehensive analyses can be made to chart the key links which successful job performance measures have with optimized personnel assignments and the increased productiviity of those already on the job.

    (3)  Not only do the occupational research approaches need continued design to produce better interpretive techniques, but the cataloguing of occupational information outputs to satisfy personnel policy questions needs better structural definition for application.

    c.  Projection:

    (1)  Exploration of dimensions of task criticality and relationships of tasks with work environments and requirements; conceptualizing the interactive nature of critical skills with quantitative and qualitative factors in job performance and unit mission capability.

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(2) Evaluation of job analysis techniques: (a) to determine the potential of alternative approaches for the provision of the required information for content of school courses and for skill achievement during on-the-job training, and (b) to design innovative steps for creating new job analysis strategies and quantifiable personnel/task performance data.

(3) Development of the occupational measurement and job engineering technology base to provide the capability by which research problems can receive intensive review and determination of the principal research directions. Resource allocation in an occupational research system can be more effectively coordinated through a careful delineation of those techniques which have the best probable payoffs.

Projected Technological Outputs:

a. Results of initial design for task criticality measures and findings of a pilot application.

b. Design of new job analysis procedures to support the construction of Skill Qualification Tests as requested by TRADOC.

c. Review of methodology to establish grade authorization standards in the context of job evaluation and policy capturing strategies.

d. Identification of job characteristics affecting unit-mission performance according to mixes of male/female soldiers.

Summary of Work Units:

a. Job Analysis Research and Engineering for Personnel Management Systems.

b. Training Feedback Information Systems: Task Analysis Research for Soldier Manuals and Criterion-Referenced Testing.

Themes:

a. Relationship of Soldier Productivity, Skill Background, and Unit Requirements.

A systems conceptualization would be useful to investigate which components of performance are essential in establishing how productivity of units can be related to individual soldier performance and his related level of skill achievement.

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b. Innovative Designs for Integrating Occupational Measurement Approaches.

Several existing and/or new job analysis methods with extensions to criterion-referenced performance should prove to be profitable if examined from a perspective whereby those methods are shown to confirm or verify certain key analysis steps in their common analytical results. Then essential job content analyses could be defined.

c. Exploration of algorithms linking required job skills, level of job grade expectation, and weapon system utilization.

Modelling of those components necessary to design an integrated performance criterion set for a prototype weapons system could produce an efficient format for specifying skill inventory, grade allocations, and personnel mix to attain progressive standards of weapon utilization or adaptation.

d. Occupational Engineering and Maintenance of Task/Organizational Factors for Optimizing Supervisory and Incumbent Performances.

A new look at what happens in occupational situations could involve several insightful contributions. Knowing which tasks are to be performed, having up-to-date work experiences, and receiving desirable reinforcement in performance can all be probed to see how some duties/tasks are related to job goals, supervisory guidelines, and an output of satisfied soldiers.

Work Unit Area: Career Productivity (Women)

Scope:

a.    Objective:  To develop methods and perspectives for conducting scientific research on the utilization of women in the Army.

b.    Background and Summary:

The Army is today using more women in more different kinds of jobs than it has at any time since the end of World War II.  At the present time, nearly six percent of the Army is female; and of the 451 different kinds of Army jobs, 415 are open to women (the exceptions being those in the combat-related areas of Air Defense, Artillery, Armor, and In- fantry).  The Army is seeking to learn more of the consequences of this development and, in particular, the probable consequences of even further developments along this line.  The Technological Base and Themes research effort outlined below is intended to identify appropriate methods and perspectives for conducting this research.

Projected Technological Outputs:

a.    Description of task assignments in traditionally-male jobs that include both men and women.

b.    Description of soldiers' attitudes concerning the utilization of women in combat roles.

c.    Identification of factors affecting job performance and satisfaction in task groups supervised by men and by women.

d.    Identification of features of Army life that have a negative impact on married soldiers' job performance, job satisfaction, and intention to remain in the Army.

e.    Information concerning the effects of several alternative research procedures.

f.    Gross measures of unit performance in TOE units with varying proportions of women.

g.    Preliminary information concerning sex differences (if any) with regard to job satisfaction in "traditional" and "nontraditional" MOS.

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Themes:

a.    Consequences of integrating significant numbers of women into previously-all-male units.

The Army has removed all gender-based barriers to the assignment to and utilization of women in any kind of Army unit that does not have a frontline combat function.  It is unavoidable that a large influx of women into non-traditional jobs will occur before the Army has accumulated experience regarding the effects various male-female mixes and various "non-traditional" role relationships have on unit performance and on longer range career attitudes, morale, training requirements and procedures, and on weapon system design implications. No modern Army has ever before attempted to incorporate women so thoroughly into its regular forces.  Research is needed to provide additional information about the following:

(1)   Factors affecting the ability of males and females to adjust to and perform well in this situation.

(2)   Factors affecting the likelihood that the group will carry out its assigned task successfully.

(3)   Utilization of women (especially in combat-type roles) in foreign Armies.

(4)   Male-female socializing across ranks and grades and the maintenance of rank or grade-based authority.

(5)   Differential communication patterns among men and among women in different ranks.

(6)   Sex-role socialization in military schools admitting women for the first time.

b.    Methods of social and psychological research in the Army.

The Army presents a number of special problems for researchers in addition to those commonly encountered by individuals conducting research in a non-Army population.  Among those of current interest, two are listed below:

(1)   Sampling in an Army population.

(2)   Situational and procedural factors affecting respondent motivation and response validity in applied social research.

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Work Unit Area:  Army Contemporary Issues/Development

Scope:

a.  Objectives:

Provide a base of scientific knowledge for dealing with institu-
ional change (both within the Army and the civilian society) as it
impacts on the adjustment of the soldier to the Army.

To study, in a longitudinal manner, the social, psychological
and behavioral adjustment of the soldier to Army life.  In addition, to
examine the current values, attitudes and beliefs of age-eligible
civilians (and their parents) concerning military service and defense
requirement.

b.  Background and Summary:

During World War II the attitudes and values of the American
soldier were studied extensively and in depth, to provide a data base
for the numerous personnel decisions required.  When the War ended,
however, this research was discontinued.  Today the Army is confronted
with personal and organizational problems (related particularly to
disciplinary infractions, and changes in the values and attitudes of
civilians toward and about the military); and the existence of these
problems, combined with the fact that extensive social and institutional
changes have occurred (both in the military as well as the civilian
society) since the 1970's, shows the need for a wide-ranging program of
systematic research.  Research efforts begun during the past fiscal year
were designed to provide an overall methodology for such research as
well as specific information concerning dimensions underlying the idea
of discipline in the Army; indicators of the quality of life of enlisted
personnel, as well as attitudinal and behavioral data concerning the
socialization and adjustment of soldiers to Army life.

c.  Projection:

The research methodology developed in FY 75 and 76 will be used
to carry out initial components of a systematic program of research on
the attitudes and values of the American soldier.  Research on the
values and attitudes of age-eligible civilians toward the military will
be implemented.  In addition, attitudinal and behavioral data concerning
positive and negative adjustment of the soldier to Army life will be
continued and expanded.

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Products and Milestones:

a. Information concerning the impact of the expectations of Army life and subsequent perception of leadership climate and peer group climate on the adjustment of enlisted men during their first six months of Army life. It is possible that data relevant to screening potentially "poorly adjusted" individuals may emerge from this effort.

b. Data regarding long-term patterns of achievement and failure among new soldiers. This information will be secured from a longitudinal analysis of information extracted from the Enlisted Master Tape Record (EMTR).

c. Data concerning the attitudes and values of civilians toward the military. The information secured from this effort is expected to have relevant applications to developing predictions of accessions under an all-volunteer environment.

Summary of Work Units:

a. Transition from civilian to military environment.

b. Longitudinal analysis for individual career management.

c. Career effectiveness in the contemporary Army.

Themes:

a. Research on discipline and its relationship to organizational and leadership climate can be viewed as part of that area of inquiry in the social sciences dealing with the relationship between attitude(s) on the one hand and behaviors(s) on the other. Given that the bulk of research on such issues as, for example, adjustment and adaptation of military personnel have used subjective – e.g. attitudinal – indicators, a conceptual and methodological model is needed that can relate (at both a theoretical and empirical level) these subjective measures with their objective counterparts.

b. Achieving effective utilization of individuals in formal organizations (e.g. the military) is frequently made more difficult because of the unique statuses certain individuals occupy (e.g. specific racial and/or ethnic identification). Research on the effective utilization of minority and majority personnel in the military that takes into account differential associations between, for example, these entering personnel and those members of the organization who are in authority positions (e.g., first and second line supervisors) is needed in order to more fully understand the processes of adaptation and to develop approaches for the effective and efficient utilization of such personnel.

Work Unit Area:  Unit Training Standards and Evaluation

Scope:

a.  Objectives:

(1)  To develop a psychometric base for further applied research into the most efficient methods for evaluating soldier performance in units.  Many problems remain to be resolved in the area of criterion-referenced testing, since the body of knowledge developed for normative testing is largely inapplicable.  Problems of test format, validity, reliability and test usage need to be reexamined.

(2)  To develop bases for defining training content and measurable standards of performance relevant to effective accomplishment of unit missions.

b.  Background and Summary:  Development of criterion-referenced tests is proceeding and of necessity must proceed in the absence of well-developed criterion test theory.  Guidance in how to construct such tests is continually being developed and distributed in the form of regulations, pamphlets, and training circulars.  This guidance is based upon the best available experience and the existing state-of-the-art in CRT.  Yet many fundamental questions remain to be answered and can be dealt with within the Technological Base context. Answers to these questions will aid in updating and improving existing guidance provided in Army field manuals such as FM21-6 "How to Prepare and Conduct Military Training" and in current Army Training and Evaluation Programs (ARTEPs) for various units.

c.  FY 76 Projection:  Work on methodological problems associated with criterion-referenced testing will continue in an attempt to develop analytic models that can be applied to the assessment of unit performance tasks.  In addition, research will be initiated in the following areas:

(1)  Assessment of Criterion-Referenced Test Validities. Research shall focus on the different measurement situations that arise as a function of test purpose, content domain, test instrument and type of inference to be drawn.  Unique measurement situations and the type of validity statements required shall be identified.

(2)  Synthetic Testing of Perceptual Motor Skills.  Administrative costs are extensive for full fidelity performance testing of Army tasks in which perceptual motor skills are major components. Less costly tests which are based only on cognitive components of such tasks generally lack validity.  This research seeks to resolve

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the theoretical problems associated with development of a methodology to identify and include critical aspects of performance in synthetic tests of task mastery.

(3) Models of Data Aggregation for a "Military Readiness Index". Vast amounts of data must be combined to determine the degree of preparedness for combat of various Army units (REDCON). Basic research is needed to explore both conceptual and mathematical models for aggregating data at various echelon levels from fire team to battalion. Linear, compensatory models dominate current thinking. Potential application of nonlinear, noncompensatory models such as the conjunctive, disjunctive, and lexicographic models should be evaluated.

(4) Estimating True Scores from Observed Scores. An observed test score represents an estimate of the true score that would result if all test items (an infinite number) could be given. In this sense, the true probability of a coin coming up heads or marksmanship ability of a tank crew can never be precisely determined. However, when each member of a group has taken the same (or highly similar) test, it is possible to use mathematical procedures in the data distribution so as to derive improved estimates of the true score. Improved true score estimation in turn results in less mastery-nonmastery misclassification error.

### Projected Technological Outputs:

a. The initial output will be a series of analytic studies referenced to existing Army criterion tests and dealing with the following topics: test format, validity, reliability, test usage, test standards, and basis for deriving test content.

b. Empirical studies on one or more of the above topics will be developed as part of the initial analytic effort. Data collection will be conducted in later stages of the program.

### Summary of Work Units:

Methodological Problems in the Development of Criterion-Referenced Tests.

### Themes:

Use of Measurement Models in the Definition and Application of Social Science Variables. This research is directed at developing a means for measuring crew/unit proficiency. The unique feature of the research is that the estimation of trial difficulty is not dependent upon any particular sample of crews, and the estimation of crew ability is not dependent upon any particular sample of crews, and the estimation of crew ability is not dependent upon any particular sample of items or trials. Research products will include analyses of data submitted by ARI, and user-oriented computer programs for implementation of the mathematical model for ability measurement.

<u>Work Unit Area</u>:   Unit Combat Training Techniques

<u>Scope</u>:

a.   <u>Objectives</u>:  To develop a technological and methodological
base to serve as a context for research on training methods and training
management concepts for unit training.

(1)   To experimentally investigate the application of principles
underlying the REALTRAIN Method to platoon and company-level tactical
operations, to additional MOS's, and to Field Artillery and Air Defense
Artillery training.

(2)   To conduct research in the context of a REALTRAIN test
bed designed to faithfully simulate small maneuver arms tactical engage-
ments.   Problems to be addressed will include: improved methods for unit
proficiency assessment, field evaluation of unit training methods, evalua-
tion of tactical doctrinal alternatives, and establishment of performance
norms for small maneuver arms units.

b.   <u>Background and Summary</u>:  Recent research by ARI has led to the
development of a methodology for realistically simulating small unit
two-sided free play engagements in the maneuver arms.   This methodology
has general utility where it is desired to simulate tactical engagements
between opposing forces.   This methodology for realistic battlefield
simulation has specific application as a training vehicle, as a tool for
individual and unit proficiency assessment, as a method for evaluating
tactical doctrinal alternatives, and as a vehicle for measuring the
training effectiveness of training devices.

For training, this methodology has led to the further development of the
REALTRAIN Method of tactical training.   REALTRAIN I, for the training
of Light Weapons Infantrymen (MOS 11B), has been implemented world-wide
in units under the name SCOPES--Squad Combat Operations Exercise (Simulation).
REALTRAIN II was designed to provide training for Tank Crewmen (MOS
11E).   It was demonstrated to senior USAREUR commanders in Germany during
fourth quarter FY 74, at which time data were collected on a methodology
for using REALTRAIN exercises for assessment of individual proficiency.

For assessment, or evaluation, the methodology has been used to investi-
gate methods for evaluating the proficiency of individuals in the
context of their unit and in the search for improved criteria and
methods for the measurement of unit performance.

A separate research project has investigated more objective criteria
for the assessment of unit performance, and developed and evaluated
a Unit Performance Assessment Model which looks at "costs" to a unit
in carrying out a mission as well as its achievements.

c. FY 76 Projection:

(1) Research will be undertaken to extend the REALTRAIN Method to platoon and company size maneuver arms units, other maneuver arms MOS's, and other combat arms. Principles which underlie the general REALTRAIN model will be selected for each new area of application and research will be conducted to determine effective and efficient procedures and techniques for maximizing training benefit. Results of research conducted during FY 75 will provide further insight into general methods for improved unit training. Research during this period will also continue to study the methodology of battlefield simulation for assessment of individual proficiency in the context of his unit and for the assessment of unit performance.

(2) The design and implementation of a test bed utilizing REALTRAIN battlefield simulation techniques will be undertaken to provide a research capability for addressing a number of critical problem areas related to training, evaluation and doctrine in the maneuver arms. The establishment of such a capability will permit:

. tryout and refinement of small unit training techniques for infantry, armor, and combined arms units

. experimental evaluation of alternative unit training techniques

. the study of more objective techniques for assessment of tactical proficiency

. experimental evaluation of tactical doctrinal alternatives

. empirical determination of performance standards expected of men and units

. field assessment of the training value of training devices and training simulation.

The establishment of the test bed will have an obvious impact on future Advanced Development research projects. REALTRAIN products resulting from future AD research, using the test bed, can be delivered to the Army for implementation.

Projected Technological Outputs:

a. A refined and expanded REALTRAIN Model.

b. Recommendations on alternative procedures and techniques for evaluating individual and unit proficiency (using the REALTRAIN method of battlefield simulation) to be evaluated in future AD research.

c. Conclusions concerning potentially useful methods for realistic simulated tactical training at platoon and company levels.

d. Tentative recommendations, to be verified by subsequent AD research, on methods for improved unit training in Field Artillery and Air Defense Artillery units.

e. Development of detailed procedures for the conduct of research using the REALTRAIN Test Bed.

Summary of Work Units:

a. Experimental Investigation of Methods of Extending the REALTRAIN Method to Other MOS's and Other Combat Arms.

b. Research on Methods for Improved Assessment of Unit Performance.

Theme:

Variables Affecting Task Performance in Small Groups:
Knowledge and Skill, Information Flow, Supervision, and Periodic Assessment

Numerous tasks in the Army, in both combat and support areas, are performed in a small group context. This may range from the functions of a squad or fire team to a divisional staff operation. Success in this context requires the application of individual skills and knowledge, and it also requires integration of individual resources into the functions of the group. In order to improve both training and doctrine for small group functions it is necessary to determine how basic group processes contribute to performance. For example:

. How is the optimum degree of individual specialization, as expressed by division of labor in the group, affected by task requirements?

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. How does cross-training of skills and knowledge add to group potential, particularly in instances of under-staffing or emergencies?

. What are the important factors regarding information flow within the group, and how do these variables operate in group performance?

. What is the proper function of feedback during task performance, for simply acknowledging an action, or for confirming the appropriateness of actions taken?

Educational Technology and Training Simulation

1.  Overview

This technical area is concerned with research aimed at developing, improving and maintaining the combat readiness posture of our active and reserve forces via the training mechanism.  It does this by developing testable concepts, evaluation techniques and principles for applying automation, simulation and training device technology:  (a)  during system design, (b)  within school, post on station environments and (c) in the military unit setting.  This requires defining, planning and executing research as required to support such areas as:  (a)  development and evaluation of alternative training concepts and strategies, (b)  derivation of training equipment requirements, (c) simulation for training system design, (d)  modelling, simulation and gaming as it applies to instructional systems targetted for school and/or unit employment, (e) all phases of computer-assisted instruction (CAI) and computer-managed instruction (CMI) and (f) test and evaluation of the resultant systems in the field for purposes of assessment, cost-effectiveness analyses and feedback techniques to improve the development process.

We are interested in creative and innovative research addressing any of these areas, but, in terms of the present stage of program development and our perceived research needs, the themes listed below are of highest priority.  They should not, however, be considered as exhaustive or restrictive, nor are they necessarily listed in order of importance.

2.  Priority Themes:

a.  Task Taxonomy  X  (Media) Delivery System:  An effort is needed which examines the typical tasks involved in military jobs, aggregated perhaps at the function level (e.g., learning identifications, perceptual discriminations, etc.), and relates them to training media/devices/techniques (or mixes) to provide the optimal learning milieu.  Of particular interest is the development of a model toward determining the optimal mix of devices, part task trainers, games, simulations, etc. for training toward a job for which a detailed task analysis has already been conducted.

b.  Video-disc Technology:  While a good deal of the projected market for videodisc technology is in the home entertainment field, a considerable potential exists for using this technology in the military training environment.  Particulary desirable is research directed at the application of this technology toward satisfying individual and team training in a limited scope, desk top war gaming environment and/or for application to maintenance and troubleshooting training.

c.  Adaptive Instruction Techniques:  Research is needed to provide the learner with an on-line interactive instruction capability which maximizes individualized training.  Included in this area is research directed toward evaluating techniques derived from artificial intelligence and heuristic modeling in the context of training and education.

d.  Instructional Displays:  A substantial effort is needed to evaluate the instructional effectiveness of both interactive computer displays and advanced display techniques which can be computer driven (e.g., the videodiscs mentioned above).  Of particular interest is the systematic exploration of the conditions under which sophisticated graphics enhance the instructional process.

e.  Technology Assessment for Training Delivery Systems:  Given adequate techniques for selecting training delivery systems (e.g., computers, film strip projection devices, etc.) the requirement exists to develop appropriate methodology for assessing the training effectiveness of these instruments once they are placed in the hands of the user.  A special need exists for the development of an appropriate methodological approach for relating these measures to cost and to develop a meaningful cost-effectiveness index.

Work Unit Area:   Human Performance Capability

Scope:

a.   Objectives:  To expand human performance capabilities for effective
operation of military units, through systematic experimental examination of
variables in critical categories, and through development of innovative meth-
odologies for experimental analyses of human performance.

(1)  To devise and develop new techniques for extending operator
performance limits in military tasks, with emphasis on problems of fatigue,
discriminative performance, and verbal and motor skills, and with particu-
lar consideration given to approaches involving unique display modifica-
tions, new work procedures, feedback contingencies, attention and alert-
ness processes, and response prediction.

(2)  To analyze and develop procedures for resisting and counter-
acting the erosive and disruptive effects of stress on operator perform-
ance, with attention to pressures generated by sustained operations,
unusual workloads, and difficult discriminations.

(3)  To explore new human performance potentials and the feasi-
bility of their application to military tasks, including detection,
development and utilization of unusual perceptual capabilities and response
capabilities.

b.   Background and Summary:

(1)  Recognition of brief noise-like signals embedded in noise,
longer post-training reliability in signal recognition, ability to better
comprehend speeded speech, faster operation of increasingly complicated
communications equipment at higher levels of performance reliability,
and high reliability of performance for longer viewing times by observers
of oscilloscopic displays are among problems involving extension of ap-
parent human performance limits which concern Army elements such as
ARADCOM, MASSTER and ACSC-E.  In the speeded speech area, feasibility
of the technique has been demonstrated, and in relation to the perceptual
and skill problems, performance techniques from experimental psychology
could probably facilitate soldier effectiveness.

(2)  The need to maintain effective soldier functioning under
various military pressures is almost axiomatic, and specific concerns
have been expressed by units within ACSC-E and TRADOC.  Relevant research
is underway on sustained performance during continuous operations, and on
effects of coping activity, distraction and responsibility in dealing
with one type of stress.  Study of factors to determine the most effective
means of presenting information in warning systems has shown, thus far,
that a single false alarm substantially reduces the effectiveness of a
subsequent warning, especially if it comes late rather than early in a
warning interval; and that the more seriously a warning is taken initially,
the less effective will such warning be, following a false alarm.

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(3)  Unusual human perceptual capacities have been reported in U.S. and foreign literature.  Considering their potential military applications, as well as scientific interest, there is need for evaluating reliability of the phenomena and/or determining procedures for detecting, reproducing and utilizing them.  Similarly, unusual human response capabilities involving internal response systems have been suggested and reported.  ARI established the Army's first laboratory facility to explore the feasibility of utilizing previously unused human response systems. In connection with possible augmentation of sensory perception, experimental data are now being analyzed to judge feasibility of using electrocardiographic changes as perceptual responses to auditory signals in military tasks.  Other possible applications of electropsychological outputs could include biofeedback uses, prediction of overt performance from properties of the internal body electrical responses, and the utilization of indicators of stress and impending fatigue to forestall performance disruption and decay.  Foreign powers, now known to be employing technology of this type, do not provide adequate technical reports, and we should independently examine this technological potential in our own facilities.

c.  FY 76 Projection:

(1)  For performance-capability expansion, research will examine factors involved in temporal organization of speech to determine applicability of relative timing techniques in facilitating language learning, the monitoring of speech in noisy environments, and more effective use of speech compression for rapid communication processing.  Other limited experimentation will deal with application of errorless discrimination techniques to human signal recognition problems, and with redundancy and differential sensitivity of human response systems.

(2)  In the stress/fatigue area, experiments will continue on sustained performance during continuous operations; effects of coping activity, distraction and responsibility on reactions to anticipated stress; and threat and false alarm as determinants of fear and avoidance of pain.

Projected Technological Outputs:

a.  Report on effect of early versus late cancellation of a threat upon the fear reaction to a second similar threat.

b.  Report on influence of probability of danger on the false alarm effect in warning systems.

c.  Report on threat and false alarm as determinants of fear and avoidance of pain.

d.  Report on feasibility of utilizing electrocardiographic changes as perceptual responses to auditory signals.

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e.   Report on sustained performance during continuous operations.

f.   Report on effects of coping activity, distraction and responsi-
bility on reactions to anticipated stress.

g.   Report on temporal organization of speech.

Summary of Work Units:

a.   Extending Human Performance Limits in Military Tasks and Systems.

b.   Sustained Performance During Continuous Operations.

c.   Effects of Coping Activity, Distraction and Responsibility on
Reactions to Anticipated Stress.

d.   Temporal Organization in Speech.

Themes:

a.   Research on Electropsychological Responses and their Application
in Resisting Stress and Fatigue, Enhancing Perception, Augmenting Per-
formance, and Discriminating Behavioral Traits.

Attempting to take advantage of previously unutilized response
systems (especially electrical outputs from internal response systems),
explorations might cover problems such as: possibilities of on-line
prediction and forestalling of stressed and fatigue states; comparison
of autonomic, covert skeletal, overt motor, and overt verbal responses
for speed and sensitivity as "reporting responses" in signal discrimi-
nation; use of one response system to "take over" when another fatigues
or fails.

b.   Experimental Analysis of Determinants of Selective Attention
and Alertness.

Experiments to pin down factors that cause failures of atten-
tion in military tasks (e.g., monitoring and operation of complex
technical equipment) and waning alertness could be especially helpful
as a basis for generating procedures to forestall such degradations
in performance.

c.   Feedback Contingencies in the Enhancement of Perception and
Establishment and Maintenance of Complex Skills.

New "errorless discrimination" procedures and other developing
techniques involving feedback contingencies are promising routes for
solving new signal recognition problems where discrimination of signal-
plus-noise from noise alone is especially difficult and critical and
for generating more rapid approaches for the establishment of reliable
skill performance in complex military tasks.

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d.   Studies of Sustained Performance, Stress and Fatigue.

While earlier data from industrial psychology have dealt with
work-rest cycles within standard work shifts, there is need for infor-
mation on the influence of circadian rhythms in this context and capa-
bilities for prolonged work beyond normal duty requirements.  Of addi-
tional interest would be information on work-work and work-rest pro-
cedures that could counteract fatigue when sustained performance is
required.

e.   Research on Psycholinguistics and Speech Perception and their
Relation to Communication Skills.

New measures, methodologies and theories from the domains of
psycholinguistics and speech perception could be explored with special
reference to problems such as: rapid scanning of speech communications
(analogous to the current approach to "rapid reading" of written text);
improved perception of poor quality speech; comprehension of compressed
speech; accurate and comprehensive summarizing of lengthy communications;
development of reliably functioning voice-operated devices.

f.   Exploring and Extending Human Perceptual Limits.

Selective reinforcement techniques and other approaches might
be worth exploring as possible approaches to the expansion of apparent
perceptual limits and would have important implications for theory as
well as practical application.  In the reinforcement area, some problems
of interest might be: lowering human thresholds for visual and auditory
signals; improve perception of poor quality speech communications through
repeated positive reinforcement of correct transcription responses to
garbled speech.

g.   Detecting, Developing and Utilizing Unusual Perceptual Capacities.

While current treatises on sensory psychology report apparent
perceptual limits for the various sensory modalities, it is possible
that these limits--e.g., in sensory acuity, amount of information that
can be processed per unit time--are extended or present in some people
although lower or absent in others.  Whether such capacities might be
detected and how they might be utilized could be matters worth exploring.

Work Unit Area:   Aircrew Performance

Scope:

a.   Objectives:   To develop principles and data describing how human performance in operating complex Army systems can be improved.

(1)   To develop basic data, principles and techniques for specifying how aviator tasks should be performed in existing and future Army systems.

(2)   To develop methods for evaluating the performance of Army aviators.

(3)   To develop and test alternative work methods for performing operational flight missions more efficiently.

(4)   To derive procedures, work methods and devices capable of increasing the effectiveness of Army aviation selection and training.

b.   Background and Summary:

(1)   This program is based on the premise that manned systems can be effectively developed and tested only through utilization of confirmed human performance prinicples and data.

(2)   A major investigation aimed at systematically determining the skills and knowledges required for NOE training has been concluded.  This study involved the following aspects:  (a) a detailed mission/function/task analysis of those tasks peculiar to NOE flight; (b) development of detailed NOE training objectives; (c) analysis of present NOE training against the objectives in (b); (d) the applicability of new training technology to the NOE training problem; (e) identification of those areas of present NOE training requiring modification; (f) recommendations for the types of research needed in order to support an all-weather NOE capability.

(3)   Functional specifications are being generated for the development of a laboratory test-bed which will permit study under controlled conditions of the pilot's responses to his visual flight environment.

(4)   Under Work Unit PREDICT (HumRRO) data on pilot and flying instructor performance have been collected as the basis for predicting success in training and in operational environments.

c.   FY 76 Projection:

(1)   Development of the laboratory test-bed needed to study the visual parameters in helicopter flight performance will be continued. The completed apparatus will be tested to ensure its compatability with operational requirements.

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(2) A study will be performed to specify a detailed syllabus for NOE flight training to be conducted at operational units. Concurrently, the potentiality of using programmed instruction techniques for teaching terrain analysis to pilots on the ground will be tested by developing a special motion picture film emphasizing the cues to be learned.

Projected Technological Outputs:

a. Development of a laboratory test-bed for controlled studies of helicopter pilot performance.

b. Development of input data describing the impact of visual parameters on pilot performance.

c. Development of a NOE flight training syllabus for unit training and a motion picture film to teach terrain analysis.

Summary of Work Units:

a. Development of Laboratory Test-Bed for Pilot Performance Studies.

b. Effective Aircrew Performance (Technological Base).

Themes:

a. Investigation of Factors Determining Aircrew Work Load

Recent changes in operational requirements make it necessary for future Army aviation (i.e., helicopter) missions to be flown at extremely low altitudes (e.g., 10 feet) both in daytime and at night. These changed requirements make severe physical and psychological demands upon pilots and aircrew, demands which are much greater than those required when flying at altitude. For example, the ability to navigate correctly at low altitudes is reduced because the pilots' ability to recognize terrain checkpoints is impaired. Nighttime flight, with the consequent reduction in visual cues, becomes extremely hazardous and stressful. The intent of this theme is to investigate potential solutions to this problem by careful controlled laboratory studies of perceptual factors influencing low level helicopter flight, determination of the physical and emotional factors producing excessive strain in pilots during flight, establishing effective work-rest cycles, and development of more effective aids (e.g., maps) for helicopter flight navigation at low altitudes.

b. Development of Techniques for Predicting Pilot Performance

A great many perceptual, psychomotor, cognitive and psycho-physiological factors influence pilot performance. In order to select pilots effectively, it is necessary to determine how these factors relate to operational performance. The intent of this theme is to investigate selected factors to determine their utility as performance predictors.

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Work Unit Area:    Organizational Development Factors

Scope:

a.  Objectives:  To improve soldier and team performance, motivation, and job satisfaction through the design and application of Organizational Development (OD) concepts and principles.

(1)  To design generalized organizational development research instruments for the diagnosis of work environment problem areas in the military.

(2)  To devise new OD techniques and programs specifically relevant to the Army and to evaluate their impact on soldier performance, team performance, and job satisfaction.

b.  Background and Summary:

(1)  Before new organizational development concepts can be successfully implemented, critical work environment problem areas must be accurately assessed.  Generalized instruments capable of the identification of critical OD problem areas in the Army are currently under development by ARI.  At present, an initial instrument has been pilot-tested, examining such factors as intra-job structure, performance feedback levels, extrinsic/intrinsic performance contingencies and supervisor-subordinate and peer relationships.  USASA Field Stations Berlin and Augsburg, Germany have served as an initial measurement test-bed for this research.  During FY 74 the test-bed for the instruments development was extended to include AADCOM field operations.

(2)  New OD techniques are currently under development for the analysis of intra-job activities.  As a prerequisite to testing new methods of job enrichment, the relationship of job activities to intrinsic/extrinsic job satisfaction, motivation and reward contingencies is currently being investigated in a series of field and laboratory studies.  This effort is integrated with the advanced development research program which is implementing work environment changes at USASA Field Station Augsburg, Germany.

(3)  Assessment of the underlying relationship between job perceptions, job satisfaction, and performance is under investigation at Field Station USASA Augsburg.  In this project, special attention is being given to the difficult tasks of determining meaningful individual and team performance criteria in complex military systems.

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c. FY 76 Projection:

(1) Initial findings on the relationship between job perceptions, job satisfaction and performance have been evaluated and cross-validation of these findings will be initiated.

(2) Research on the design of new OD concepts and techniques will be continued. Initial data on the relationship between intra-job activities and intrinsic/extrinsic satisfaction, motivation and performance reward contingencies will continue to be analyzed. As a result of this effort, new job enrichment concepts will be designed and tested as part of the advanced development research program.

(3) The generalizability of techniques used for obtaining meaningful criteria of individual and team performance will be examined for other USASA field systems and extended to include AADCCM field operations.

Projected Technological Outputs:

a. Information on the relationship between job perceptions, satisfaction, and performance.

b. An analysis of the relationship between intra-job activities and intrinsic/extrinsic satisfaction, motivation and reward contingencies.

c. A method for determining meaningful performance and motivation criteria in complex military systems.

d. Initial information for restructuring intra- and inter-job activities so as to enhance soldier and team productivity and job satisfaction.

e. An initial instrument for diagnosis of OD problem areas in complex Army systems.

f. Generalization of the current OD test-bed effort to the Air Defense working environment.

g. Examination of the feasibility of applying organizational management skill development techniques to selected military units (HumRRO).

Summary of Work Units:

a. The Diagnosis of OD Problem Areas and the Development of OD concepts and Principles for Increased Soldier and Team Performance and Job Satisfaction.

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b. The Relationship of Job Perceptions, Job Satisfaction, and Soldier Performance.

c. Development of Organizational Management Skill Techniques for Use in a Military Setting.

d. Investigation of Sources of Job Expectations.

Theme:

A Predictive Model of Military Performance Motivation

Much recent research in the field of organizational psychology has focused on predictive models of work motivation. The most promising model has dealt with workers' expectancies concerning various outcomes of their job performance. Of concern is the extent to which a worker perceives such factors as promotion, job challenge, and leave time as related to his job performance. Where the worker perceives that strong relationships exist between his performance and those factors, the expectancy model predicts that he will be motivated to superior performance. While research conducted in a range of work settings has demonstrated the validity of the basic model, more than half of the variance in performance motivation still remains unexplained. Research is required which extends expectancy theory models to include measures of the relative and combined importance of intrinsic and extrinsic variables, military performance motivation and to include the influence of the organizational environment on work motivation, e.g., influence of peer group, of formal and informal leaders. Methodological investigations for the inclusion of individual characteristics in predictive models and for the development of operationally relevant measures of performance motivation for military organizations are also needed.

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Research Area:   Human Factors Technology for Tactical Information Processing
                 and Presentation

Scope:

   a.  Objectives:  To provide technological advances for enchancing user
performance in complex man-machine battlefield information systems by:

   (1)  Determining principles for allocating functions to man, computer
and man-computer interaction.

   (2)  Developing a methodology for generating performance parameters
and functions representing the relationship between information processing
tasks and presentation media and characteristics.

   (3)  Developing concepts and principles to improve the learnability
and utilization of language and functional aids for more efficient person
to person and person to computer communication.

   b.  Background and Summary:

       The planned introduction of computer-based military information
systems into tactical operations offers the potential for greatly improved
performance in terms of more rapid, accurate, complete and meaningful
transfer, analysis, interpretation, and utilization of battlefield informa-
tion.  Realization of this potential is contingent upon the availability
of a technology base which supports methodological and procedural innovation's
designed to capitalize on and compensate for the respective strengths and
weaknesses of man and computer.

   (1)  Extending and complementing rather than supplanting man's role
in tactical information processing is of paramount concern.  Requisite to
this concern is a basic understanding of man's perceptual and cognitive
capabilities and limitations as they relate to screening, transforming,
aggregating, integrating and interpreting varying amounts, types and
qualities of relevant-irrelevant, harmonius-dissonant, and dependent-
independent information as a function of time.

   (2)  Information processing tasks cover the gamut from detection and
identification of objects from sensory cues, or analog representations
from these cues, to inferential judgments based on the recognition of
patterns of activity and deployment among maneuver size forces and supporting
elements.  The effectiveness of man in accomplishing these tasks may in
large part depend on the form and characteristics of the presentation
(display) media utilized.  Salient dimensions along which information
processing tasks vary need to be identified and principles developed
relating these tasks to static-dynamic, graphic-alphanumeric, visual-auditory,
and black and white-color, situation portrayal.

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(3) The effectiveness of any computer-based information system is directly related to the efficacy of communication within that system. Ideally the user should be able to quickly and easily utilize the system which implies that the characteristics of the coding, language, data organization and file structure should be as consistent as feasible with the logical processes of a skilled user. Additionally, principles upon which to base procedures that will compensate for differences in efficacy attributable to a self-actualizing vs force feeding modes of operation need to be developed.

c. Specific FY 1976 Candiate Tasks: Within the objectives defined but by no means exhaustive thereof are the following research topics/tasks.

(1) a. New Theorectic Approaches for Information Processing/Decision Aiding.

b. Optional Stopping and the Value of Information.

c. Individual Differences and the Acceptance of Decision Aiding.

d. Relative Impact of Information Parameters on Information Processing Performance.

(2) a. Perceptual and Cognitive Factors Associated with Pattern Recognition Performance.

b. Differential Display Characteristics for CRT Presentation of Static and Dynamic Information.

c. Factors Determining the Relative Effectiveness of Pictorial, Graphic and Alpha-numeric Displays.

d. Effects of Multiple Coding Dimensions of Symbolic Representations on Information Transmission.

(3) a. Techniques and Rules for Mnemonic Encoding of Information System Inputs.

b. Macro Building Techniques for "Smart Terminals" Distributed Data Base Systems.

c. Distractive vs Aiding Effects of Background Communication on Situational Awareness.

d. Impact of Direct Computer Access on Organizational Information Processing.

APPENDIX 1

BRIEF DESCRIPTION OF THE ARMY RESEARCH INSTITUTE

The U. S. Army Research Institute for the Behavioral and Social Sciences (ARI) is a field operating agency of the Deputy Chief of Staff for Personnel (DCSPER), Department of the Army. In October 1972, ARI was established as the Army's developing agency for research and development efforts in the behavioral and social sciences.

ARI replaced the U. S. Army Manpower Resources Research and Development Center, including the former Behavior and Systems Research Laboratory (BESRL), and Motivation and Training Laboratory (MTL) and took over some functions of the former Army Research Office of Arlington.

ARI's mission is one of providing scientific and technical support to the human resources needs of the Army, using techniques and disciplines of behavioral and social science. ARI conducts:

. A Technological Base Program of research and exploratory development including a Research Themes Program,

. An Advanced Development Program, which uses the results of research to aid Army users in dealing with specific identifiable needs or problems and

. A Technical Advisory Service Program, which provides help to Army users on problems whose solution does not require research or development.

ARI is made up of selected military personnel and professional civilians including psychologists, sociologists, statisticians, mathematicians and computer specialist engineers plus appropriate administrative and support personnel. The Institute is problem- and product-oriented, with a staff which responds to and works with Army agencies and commands worldwide.

ARI's work program is regularly reviewed by the Research and Development Advisory Group (RDAG), an extension of the Army Scientific Advisory Panel. The RDAG is made up of selected scientists from universities and industry and its function is to review, advise and critique the ARI Technology program. Military user review is provided by the Human Resources Research Program Review Committee (HRRP-RC), a General Officer Board of Deputy Chief of Staff for Personnel.

The Institute executes its research programs through its two laboratories; administrative and other support is provided by its headquarters staff. Each laboratory is organized into separate areas of technical concentration and includes field units as well as facilities and personnel at Arlington.

APPENDIX 2

SUBMISSION OF PROPOSALS FOR BASIC RESEARCH

## 1. Introduction

a. This appendix is included for the convenience of prospective grantees or contractors in preparing and submitting unsolicited proposals for support of research related to the themes and research program described in this brochure. Information herein describes ARI policy and is in agreement with regulations current when this brochure was prepared. If information herein differs from the provisions of the Armed Services Procurement Regulations the latter shall govern.

b. Proposals for the support of basic research by ARI may be submitted at any time and should be mailed to

> Army Research Institute
> ATTN: PERI-RC
> 1300 Wilson Boulevard
> Arlington, Virginia 22209

c. A letter of inquiry, or an informal preliminary proposal, is suggested to ascertain ARI's possible interest in a proposed project, prior to submission of a formal proposal.

## 2. Grants and Contracts

a. As indicated in the Foreword, ARI can support basic research either by a research grant or a research contract. Differences between these types of support are:

(1) The grants program is limited to non-profit organizations;* a contract may be awarded to any responsible legal entity.

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*The term "nonprofit organization" used herein means (1) an institution of higher education not operated for profit, one of the objectives of which is the teaching and training of personnel in the knowledge of the arts and sciences; (2) a research organization, not organized nor operated for profit, the primary purpose of which is the conduct of scientific research and the net earnings of which do not inure to the benefit of any individual or group of individuals; or (3) a hospital operated on a nonprofit basis provided that one of its objectives is the teaching and training of personnel in advanced knowledge of the healing arts and sciences or that its primary purpose is the conduct of scientific research.

(2) Payments under grants are normally advanced to the grantee; payments under contracts require submission of vouchers following expenditures.

(3) Grantees are expected to share part of the cost of the research; basic research contracts normally provide full reimbursement of costs and may include fee or equivalent.

(4) It is the policy of ARI to prefer contracts where the nature of the work or product can be specified in advance, where extensive effort is contemplated, where the participation of military personnel in the research is required or where close monitoring is desired.  Grants are preferred where the work cannot be specified in advance, where originality and creativity are emphasized, where the most appropriate research approaches are relatively unstructured, where the effort is relatively small and where military participation is not required.

3.  Following the above guidelines the organization submitting the proposal should request either a grant or contract agreement.

4.  Form of Transmittal

a.  To expedite the review process proposals should be submitted in four copies.

b.  No standard form of statement is required,  All proposals should contain the essential information specified below and should bear the signature of the principal investigator(s), and an official authorized to sign for the institution:

(1) The name and address of the organization submitting the proposal. Where the legal or corporate designation of the organization is different from the popular commonly used designation, the legal designation should be used.  For grant proposals include information sufficient to establish that the grantee is eligible for a grant under Public Law 85-934.

(2) The name and title of the proposed principal investigator(s), a brief biographical sketch, a list of recent publications, and a statement of other duties with respect to teaching and research.

(3) A brief title of the research to be performed, and a concise abstract.  This should be followed by a detailed statement of the work to be undertaken, its objectives, and its relation to the present state of knowledge in the field.  The anticipated procedure should also be outlined. The appraisal of the scientific merit of the proposed research will be influenced by the adequacy and character of this information.  ARI is aware that research cannot be planned in complete detail in advance.

(4) A budget, including:

(a) a detailed estimate of cost proposed.

(b) a list of participants, not necessarily by name, showing approximate percent of time to be spent by such individuals as chief investigator(s), research associates, and assistants, the rate and the total amount to be paid to each from the contract or grant. It is the policy of ARI not to pay any salary that will increase the monthly rate of pay over that normally paid by the proposed grantee or contracting organization.

(c) the policy of the Department of Defense is for the grantee/contractor to provide equipment. If, however the grantee/contractor is unable to do so, an itemized listing of equipment necessary for successful performance including a cost breakdown should be provided.

(d) expendable equipment and supplies, indicated in general terms.

(e) contemplated expenditures for travel, with brief explanation. Travel outside continental U. S. requires separate approval by ARI.

(f) other direct costs, such as publication, communication, transportation, etc.

(g) Indirect costs. In the case of contracts, the normal established overhead rate of the contracting institution will be used. In the case of grants, if funds are requested to defray indirect costs as well as direct costs, the rate will be subject to negotiation with ARI representatives before the grant is made. However, the indirect cost rate used for determining grant amounts will not exceed the indirect cost rate that has been determined most recently under applicable procedures at the grantee institution for comparable research contracts of the U. S. Government.

(h) Cost sharing - Grants. The annual Department of Defense Appropriations Acts require the grantee to share the costs of research projects supported by grants. This may be accomplished through either direct or indirect costs.

(5) Facilities available for conducting the research.

(6) Desired starting and completion dates of the research agreement.

(7) The names of other potential sponsors to which the proposal is being sent; list of active research projects for which the principal

investigator is receiving support from outside his institution, including titles, sponsors, amounts per year (including academic year and/or summer support), and termination dates; pending proposals submitted to other sponsors by the principal investigator(s); and list of other teaching, research, and administrative duties of the principal investigator(s).

5. Evaluation of Proposals

Unsolicited proposals for research support will be evaluated primarily on the basis of scientific merit, the capabilities of the investigator(s) and the relevance of the proposed research to the research, development or operational needs of the Army. The evaluation process normally requires three or four months. ARI cannot support all scientifically meritorious proposals that are submitted and must consider the balance of emphasis within the over-all program, research funds available, the cost of the proposed research, and the relative priority of Army need for research in a given area.

6. Report Requirements

a. Grants require progress reports, fiscal reports and a final comprehensive report. Interim technical reports may also be submitted. Publication of interim technical reports in the open literature is generally preferred. Details of report format will be provided after proposals have been accepted.

b. For contract research additional requirements for reports or other deliverable items may be specified in the research agreement. Contracts will also require financial reports or vouchers.

7. Administration of Grants and Contract Research

a. Upon the approval of a research proposal by ARI, the proposing organization will be notified and a research agreement (grant or contract) will be executed. Research agreements will normally be made for one year.

b. Army policy is to assume that once a research agreement is in effect the principal investigator is in the best position to determine the means by which the research may be conducted most effectively. It should be further noted that he must be an employee of the proposing organization. In the case of contracts ARI will assign a Contracting Officer's Technical Representative (COTR) to work closely with the research team. In addition to providing for the usual duties of a technical monitor, this assignment is intended to provide experience with the method and progress of the research to assure in-house capability to replicate or continue the research.

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APPENDIX 3

GLOSSARY

| | |
|---|---|
| AADCOM | Army Air Defense Command(er) |
| ACSC-E | Assistant Chief of Staff for Communications and Electronics |
| AIT | Advanced Individual Training |
| ARADCOM | United States Army Air Defense Command |
| BCT | Basic Combat Training |
| BICC | Battlefield Information Control Center |
| Category IV | An interval of scores on the Armed Forces Qualification Test including approximately the 10 to the 30 percentile of the U. S. population. |
| G 2 | Specifically, the officer on a general staff (i.e., division level or higher) responsible for military intelligence; by inference, the functions for which he is responsible. |
| G 3 | The officer on a general staff responsible for military operations; viz., condition, development, movement, and fire of his own and friendly forces. |
| HumRRO | Human Resources Research Organization - Formerly an Army Federal Contract Research Center, now an independent non-profit research organization specializing in human resources research. |
| MASSTER | Modern Army Selected System Test, Evaluation and Review. An Army program to provide performance evaluation under field conditions of critical new Army equipment and systems. |
| MILPERCEN | Military Personnel Center. A special staff agency of the Department of the Army responsible for assignment and career management of military personnel. (Formerly the Office of Personnel Operations, OPO.) |

| | |
|---|---|
| MOS | Military Occupational Specialty |
| NOE | Nap-of-the-earth - flying close to the ground to minimize detection and interception using terrain and other objects to provide cover. |
| OER | Officer Efficiency Report - An official rating of an officer by his immediate superior officer completed annually or upon transfer. |
| OPD | Officer Personnel Directorate - One of the major subdivisions of MILPERCEN. |
| OPMS | Officer Personnel Management System - The Army's career program for commissioned officers. |
| RR/EO | Race relations/equal opportunity |
| System Engineering (Training) | An approach to developing a training program which involves precise determination of output requirements and explicit measurement to determine that specifications are met. |
| TO&E | Table of Organization and Equipment |
| TO&E unit | An Army unit, particularly a combat unit, for which an Army-wide standard complement of personnel (by rank and MOS) and equipment has been prescribed. TO&E units do not include civilians. |
| TOS2 | Tactical Operations System - TOS Operable Segment. |
| TRADOC | Training and Doctrine Command |
| USAREUR | United States Army Europe |
| USASA | United States Army Security Agency |

APPENDIX 4

REQUEST FOR THEME BROCHURE

Forward copies of this $\boxed{\phantom{x}}$ and subsequent $\boxed{\phantom{x}}$ theme brochures to the following:

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